

WHAT IS CLAIMED IS:

1 1. A method of reallocating data among physical disks corresponding to a
2 logical disk, the method comprising:
3 partitioning a logical disk into a plurality of groups, each group comprising at
4 least one segment on at least one of a first plurality of physical disks corresponding to the
5 logical disk;
6 partitioning one group of the plurality of groups into a plurality of sub-groups;
7 and
8 for each sub-group of the plurality of sub-groups but one, copying the sub-
9 group to at least one segment on at least one of a second plurality of physical disks
10 corresponding to the logical disk.

1 2. The method of claim 1, further comprising:
2 determining a highly accessed group of the plurality of groups; and
3 wherein partitioning one group includes partitioning the highly accessed
4 group.

1 3. The method of claim 1, further comprising repeating the partitioning
2 one group step and repeating the for each sub-group, copying the sub-group step for another
3 group of the plurality of groups.

1 4. The method of claim 1, further comprising indicating the one sub-
2 group of the plurality of sub-groups as a new group in the plurality of groups.

1 5. The method of claim 4, further comprising indicating each sub-group
2 of the plurality of sub-groups but the one as a new group in the plurality of groups.

1 6. The method of claim 1 further comprising, for the one sub-group of the
2 plurality of subgroups, copying the sub-group to at least one segment on at least one of the
3 second plurality of physical disks.

1 7. The method of claim 1 further comprising:
2 receiving a request to read data from one of the sub-groups of the plurality of
3 sub-groups but the one;
4 determining whether the requested sub-group is currently being copied;

5 if not currently being copied, reading the data from the sub-group on the at
6 least one of the second plurality of physical disks;
7 if currently being copied, reading the data from the group corresponding to the
8 sub-group on the at least one of the first plurality of physical disks.

1 8. The method of claim 1 further comprising:
2 receiving a request to write data to one of the sub-groups of the plurality of
3 sub-groups but the one;
4 determining whether the requested sub-group is currently being copied by
5 checking a status of the one of the sub-groups;
6 if currently being copied, changing the status of the one of the sub-groups to
7 indicate that copying of the one of the sub-groups is completed; and
8 writing the data to the one of the sub-groups.

1 9. The method of claim 8 further comprising, if currently being copied,
2 writing the data to the group corresponding to the one of the sub-groups on the at least one of
3 the first plurality of physical disks.

1 10. A storage device comprising:
2 a first plurality of physical disks corresponding to a logical disk, wherein the
3 logical disk is partitioned into a plurality of groups, each group comprising at least one
4 segment on at least one of the first plurality of physical disks;
5 at least a second physical disk corresponding to the logical disk;
6 a processor, coupled with the first plurality of physical disks and with the at
7 least a second physical disk, the processor configured to:
8 partition one group of the plurality of groups into a plurality of sub-
9 groups; and
10 for each sub-group of the plurality of sub-groups but one, copy the
11 sub-group to at least one segment on the at least a second physical
12 disk; and
13 a disk controller, coupled with a first memory, with the first plurality of
14 physical disks and with the at least a second physical disk, and coupled to receive I/O
15 requests for the logical disk from at least one host computer, the disk controller configured to:

16 determine one or more of the physical disks of the first plurality of
17 physical disks and the at least a second physical disk to which an
18 I/O request corresponds; and
19 perform the requested I/O to the determined one or more of the
20 physical disks.

1 11. The storage device of claim 10, wherein the processor is further
2 configured to:
3 determine whether an I/O request to read data corresponds to data
4 within a sub-group being copied to the at least a second physical
5 disk;
6 if not currently being copied, read the data from the sub-group on the
7 at least a second physical disk;
8 if currently being copied, read the data from the group corresponding
9 to the sub-group on the first plurality of disks.

1 12. The storage device of claim 10, wherein the processor is further
2 configured to:
3 determine whether an I/O request to write data corresponds to data
4 within a sub-group being copied to the at least a second physical
5 disk;
6 if currently being copied, change a status of the sub-group to indicate
7 that copying of the sub-group is completed; and
8 write the data to the sub-group on the at least a second physical disk.

1 13. The storage device of claim 12, wherein the processor is further
2 configured to write the data to the group corresponding to the sub-group on the first plurality
3 of physical disks.

1 14. A method of reallocating data among physical disks corresponding to a
2 logical disk, the method comprising:
3 partitioning a logical disk into a plurality of groups, wherein each group
4 comprises a plurality of segments on at least one of a first plurality of physical disks
5 corresponding to the logical disk;
6 determining a most frequently accessed group of the plurality of groups;

7 partitioning the most frequently accessed group into a plurality of sub-groups,
8 including partitioning each segment of the plurality of segments comprising the most
9 frequently accessed group into a plurality of sub-segments, wherein each sub-group
10 comprises at least one sub-segment;

11 for each sub-group of the plurality of sub-groups but one, allocating at least
12 one segment on at least one of a second plurality of physical disks corresponding to the
13 logical disk, each segment on the second plurality of disks corresponding to the at least one
14 sub-segment comprising the sub-group; and

15 for each sub-group of the plurality of sub-groups but the one, copying the
16 corresponding at least one sub-segment to the corresponding at least one segment on the at
17 least one of the second plurality of physical disks.

1 15. The method of claim 14 further comprising, for the one sub-group of
2 the plurality of sub-groups:

3 allocating at least one segment on at least one of the second plurality of
4 physical disk, each segment on the second plurality of disks corresponding to the at least one
5 sub-segment comprising the one sub-group; and

6 copying the corresponding at least one sub-segment to the corresponding at
7 least one segment on the at least one of the second plurality of physical disks.

1 16. A storage device comprising:
2 a first plurality of physical disks corresponding to a logical disk, wherein the
3 logical disk is partitioned into a plurality of groups, each group comprising at least one
4 segment on at least one of the first plurality of physical disks;

5 at least a second physical disk corresponding to the logical disk;

6 a processor, coupled with the first plurality of physical disks and with the at
7 least a second physical disk, the processor configured to:

8 partition one group of the plurality of groups into a plurality of sub-
9 groups; and

10 for each sub-group of the plurality of sub-groups but one, copy the
11 sub-group to at least one segment on the at least a second physical
12 disk.

1 17. The storage system of claim 16, wherein the processor is further
2 configured to determining a highly accessed group of the plurality of groups, and wherein
3 partitioning one group includes partitioning the highly accessed group.

1 18. The storage system of claim 16, wherein the processor is further
2 configured to repeat the partitioning one group step and to repeat the for each sub-group,
3 copying the sub-group step for another group of the plurality of groups.

1 19. The storage system of claim 16, wherein the processor is further
2 configured to, for the one sub-group of the plurality of subgroups, copy the sub-group to at
3 least one segment on at least one of the second plurality of physical disks.

1 20. The storage system of claim 16, wherein the processor is coupled to
2 receive I/O requests for the logical disk from at least one host computer, and wherein the
3 processor is further configured to:

4 determine one or more of the physical disks of the first plurality of
5 physical disks and the at least a second physical disk to which an
6 I/O request corresponds; and
7 perform the requested I/O to the determined one or more of the
8 physical disks.